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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : B27N 3/18 — A1

(11) International Publication Number: WO 97/04932

(43) International Publication Date: 13 February 1997 (13.02.97)

(21) International Application Number: PCT/SE96/00974

(22) International Filing Date: 25 July 1996 (25.07.96)

(30) Priority Data:
9502713-2 27 July 1995 (27.07.95) SE

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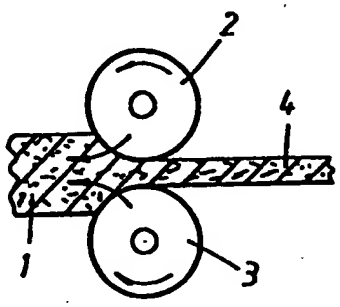
(81) Designated States: AL, AM, AT, AU, AZ, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: A METHOD FOR PRODUCING LIGNOCELLULOSIC BOARDS

(57) Abstract

A method for the continuous production of boards of a ligno-cellulosic fiber material wherein the material is broken up into particles and/or fibers. These are dried, glued and formed to a mat. The mat is compressed to a finished board while steam is introduced. According to the present invention, the compression is performed as a single step and the steam is introduced through one or many compression rollers. By injecting steam in this way a sufficient cure is obtained to withstand the spring back characteristics inherent of the fibers so that it is possible to obtain a finished thickness of the board with one single compression step.



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A Method For Producing Lignocellulosic Boards

The present invention relates to a method of producing lignocellulosic boards according to the preamble of claim 1.

Methods of producing boards of lignocellulosic material are well known and have significant practical applications. The manufacturing includes the following main steps: breaking up of the raw material to particles having a suitable size and/or fibers, drying to a predetermined moisture ratio and gluing of the material before or after the drying, forming of the glued material into a mat which may be constructed of several layers, possibly cold pre-compressing, pre-heating, water spraying of surfaces etc. and heat compressing under pressure and heat in a stroke compressor or a continuous compressor until the board is finished.

During conventional heat compressing, the compressed material is heated mainly by using heat coils from adjacent heating plates or the steel bands. These have a temperature of 150-200° Celsius depending on the type of product that is being compressed, the type of glue used, desired capacity etc. In this way, the moisture in the material is evaporated closest to the heat sources so that a dry layer is developed in this area and the steam front gradually moves towards the center of the board from each side as the compression continues. When the dry layer has been developed this means that the temperature in this layer is at least 100° Celsius which initiates the curing of conventional glues. When the steam front has reached the center, the temperature at the center has reached at least 100° Celsius and the boards even starts to cure at its center so that the compression can be stopped within a couple of seconds. This applies to situations when conventional urea formalaldehyde glue (UF) and similar glues are used such as melamine fortified (MUF) glue. When other glues, having a higher curing temperature, are used then a higher temperature and a greater steam pressure is required in the board before any curing can start.

To achieve the desired density, a compressor must apply a high surface pressure at a high temperature. This is not a problem for non-continuous compression in a so called stroke compressor but such compressors have other drawbacks such as worse thickness tolerances etc. When continuous compressors are used, the requirement for high surface pressures and high temperatures at the same time have led to expensive high precision solutions with regard to the roller felt between the steel band and the

heating plate positioned below. The method of providing heat to the board via heat coils makes the heating relatively time consuming which results in long compression lengths (large compression surfaces).

The heating can also be achieved by delivering steam to the mat to be compressed. In this way, the heating time is drastically shortened and, in addition, the resistance of the material to compression is drastically reduced when steam is introduced so that less compression forces and smaller compression surfaces are required. An injection box may be used to inject steam into the material mat which has certain drawbacks though. To avoid these drawbacks, compression rollers have been developed that are perforated and functions as a steam delivery member. Such an apparatus is disclosed in SE 502,810.

SE 502,272 describes a method that uses the advantages of steam heating for achieve the desired density profiles of the finished board. The compression is performed in two steps wherein the mat in the first step is compressed to a moderate density having a substantially even density profile across the thickness thereof. In the second step, the mat is compressed to a higher density where the density profile is heterogeneous so that the surface layer has a higher density than the middle portion of the board. Between both of the steps the board is either fully cured or partially cured.

Although this represent an advance within the field of manufacturing particle boards, the method according to SE 502,272 has the drawback that the two step compression with the intermediate step of curing makes the manufacturing process relatively complicated.

The use of steam injection for heating the material is well known in the industry. For example, EP 383 572, U.S. 2 480 851, GB 999 696, DE 2 058 820, DE 36 40 682, DE 40 09 883 and AU 57390/86 show different examples of how steam is injected at continuous processes to produce fiber boards. Even these described processes require compression in two or more steps.

EP 383 572 further describes a process that only works with one compression step. In this process, the steam is introduced in a steam injection segment which apparently includes some type of conventional steam delivery through a steam box or a similar device. When introducing steam in this way, there is some sliding between the mat/weave and the steam box which creates a substantial wear so that the sliding surfaces of the box must be replaced at regular intervals and problems with the sealing

of the edges may occur as a result of the sliding of the fiber mat/weave relative to the steam box.

The object of the present invention is to provide a method of this kind that is simpler than the methods of the prior art and that avoids the drawbacks that are associated with conventional ways of introducing steam.

This has been achieved according to the present invention through the method described in the preamble of claim 1 and the steps described in the body of claim 1.

By analyzing the results of the methods described in SE 502,272 it has been determined that the glue, that is already provided with the steam injection in connection with the first compression step, can be made to cure and be sufficiently strong to withstand the inherent spring back characteristics of the particles/fibers included in the material. It is therefore possible to obtain a board already in the first stage that has a thickness that mainly corresponds to the desired thickness of the finished board. The board may require conditioning after the compression step.

By accomplishing the steam injected compression in only one compression step, a substantially easier and less expensive manufacturing process is obtained.

By also introducing steam in this only compression step through the rollers, the problems that are associated with conventional steam delivery methods are avoided. Preferably, the compressed board is permitted to pass through a heating zone. In this way, the glue, that normally does not fully cure to full strength during the compression, can cure to full strength in this zone.

Before and after the compression, the mat/weave is preferably conditioned.

The above mentioned advantages and other preferred embodiments of the method of the present invention are described in the dependent claims.

The method of the present invention are described in more detail below in the detailed description of a preferred embodiment of the invention with reference to the appended figures wherein

fig. 1 is a cross sectional view that schematically shows the compression step according to a first embodiment of the present invention,

fig. 2 is a cross sectional view that corresponds to fig. 1 but shows a second embodiment of the present invention,

fig. 3 is a schematic cross sectional view of a roller through which steam is introduced,

fig. 4 is a cross sectional view of a portion of fig. 3,

fig. 5 is an axial cross sectional view through the roller of fig. 4,

fig. 6 is a schematic cross sectional view that illustrates the different treatment steps according the a preferred embodiment of the present invention.

Fig. 1 illustrates the compression of a material mat 1, that includes, among other things, fibers and glue, in one single step to form a fiber board that has a thickness that substantially corresponds to the thickness of the finished board. The compression of the board 1 is performed by two compression rollers that include members for introducing steam to the mat in connection with the compression thereof. By introducing the steam to the mat, the glue components will cure and obtain a sufficient strength to withstand the spring back characteristics. This enables the compression of the board in one single step. The steam is pushed backwardly against the material i.e. against the direction of movement of the material.

Fig. 2 shows an alternative embodiment of the present invention where each roller 2, 3 are equipped with surrounding endless wires 19, 20 or in the alternative a steel band with holes and the endless wire.

The rollers 2 and 3 including the steam delivery systems can be constructed in the way that is described in SE 502,810 and that is shown in figs. 3, 4 and 5.

The compression and injection roller 2 that is shown in fig. 4 is constructed with a perforated casing surface 6 for delivering steam to the mat 1. An axial channel system 7 is disposed inside the casing surface 6 around the roller 2. The channel system 7 is adapted to distribute the steam over the roller 2 and thus along the width of the mat 1. An adjustable sliding shoe (fig. 5) is arranged to sealing engage an end of the roller 2 to introduce steam into the channel system 7. The introduction of steam is thus performed to a limited section (fig. 3) of the roller 2 where the mat 1 is compressed. The limited sector 9 is surrounded at both sides, as seen in the periphery, by sealing zones 10 where the roller 2 is in contact with the mat 1. The channel system 7 can be closed at the opposite end of the roller 2. In the alternative, a sliding shoe 8 can be disposed at each of the ends.

The sliding shoe 8 is held in place by an adjustable stand so that the sliding shoe is adjustable along the direction of the periphery. In the way, the position of the injection sector 9 can be varied. The sliding shoe 8 is preferably includes a replaceable wear part 14 made of a low friction material that bears against a treated surface on the

end of the roller 2. Thus, the sliding shoe 8 is held and pushed against the end of the roller 2 by, for example, springs, compressed air or hydraulically, so that any leakage in the sealing surface is minimized.

The sliding shoe 8 can be constructed with one or more channels 11, 12, 13 that can have different surface areas. Even replaceable wear parts 14 having different openings defined therein may be used such as a sliding plate having an opening that can be varied. Thus, the size of the injection sector 9 can be varied. What is more, different flows and pressures can be maintained in different parts of the injection sector 9. The channels of the sliding shoe 8 can also be used for cleaning and suction.

Fig. 5 schematically shows the contact surface of the sliding shoe 8 against the end of the roller 2. In this way, the sliding shoe 8 is equipped with injection channels 11 for steam, cleaning channel 12 and suction channel 13.

The perforated casing surface 6 on the roller 2 can be a stamped or drilled sheet metal having the shape of rings that have been heat shrunk onto the roller. Axial support moldings 15 for the sheet metal can be shaped into the casing sheet metal 16 on the roller by milling or casting or the sheet metal may be constructed as separate moldings that are attached to recesses in the casing sheet metal 16. These moldings can at the same time limit the channel system 7 disposed inside the casing surface 6.

The openings of the channel system 7 at the end of the roller that have not been covered by the sliding shoe 8 can be sealed by pressing an adjustable sliding ring made of a low friction material against the end.

Fig. 6 shows a one step compression according to the present invention including the various treatment steps that preferably occur before and after the actual compression. The material mat 1 is first passed through a pre-conditioning zone 21 where it is conditioned to a predetermined temperature, moisture content and density.

After the compression between the rollers 2, 3, the compressed board 4 is passed through a heating zone 22. In this zone, the glue, that has been sufficiently cured in connection with the compression and is sufficiently strong to withstand the spring back characteristics of the fibers, is permitted to cure completely. To achieve an optimal strength in the finished board 4, the temperature in the heating zone is the same or very close to the temperature at the nip rollers.

The fully cured board is then finally passed to an after-conditioning zone 23. In this zone, the board is given the moisture content that is desired for the finished

product. Furthermore, gases are collected in this zone such as formalaldehyde that is emitted by the compressed board. The board is also cooled in the conditioning zone because the high temperature of the board provided by the heating zone 22 makes the board plastic to a certain degree which gives it poor handleability.

Patent Claims

1. A method for the continuous production of boards of a ligno-cellulosic fiber material wherein the material is broken up into particles and/or fibers, dried, glued and formed to a mat that is compressed to a finished board with at least one compression roller and wherein the steam is introduced to the formed mat, c h a r a c t e r i z e d t h e r e i n, that the compression is performed in one single step during which the steam is introduced through at least one compression roller.

2. The method according to claim 1, wherein the steam is introduced in such an amount that any air contained in the mat is pushed back through the mat.

3. The method according to claims 1 or 2, wherein the mat is pre-conditioned prior to the compression thereof.

4. The method according to claim 3, wherein the pre-conditioning includes conditioning to a predetermined temperature, moisture content and density.

5. The method according to claims 1-4, wherein the compressed board is passed to a heating zone.

6. The method according to claim 5, wherein the compressed board is kept in the heating zone a sufficient time so that the glue in the board is cured to its full strength.

7. The method according to claims 5 or 6, wherein the compressed board is held in the heating zone at a temperature that substantially corresponds to the temperature of the board during the compression thereof.

8. The method according to any of the claims 1-7, wherein the compressed board is passed to an after-conditioning zone.

9. The method according to claim 8, wherein the treatment in the after-conditioning zone includes changing the moisture content of the compressed board and to separate gases emitted from the compressed board.

10. The method according to claims 8 or 9, wherein the compressed board is cooled in the after-conditioning zone.

Fig. 1

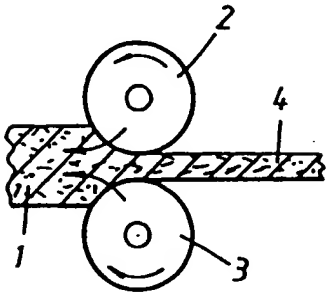


Fig. 2

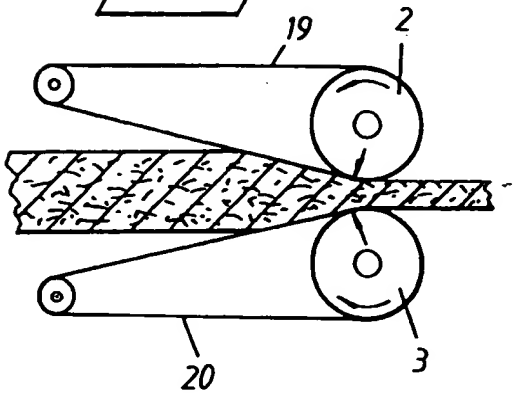


Fig. 3

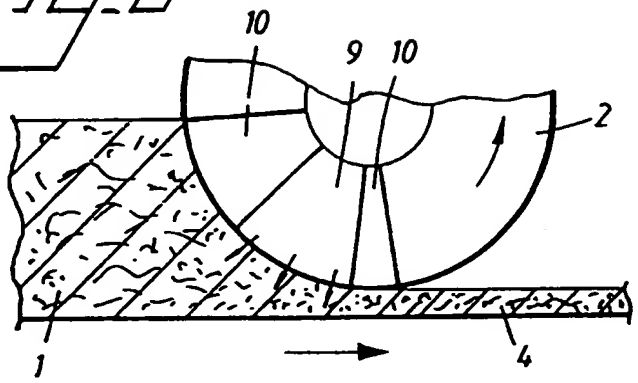
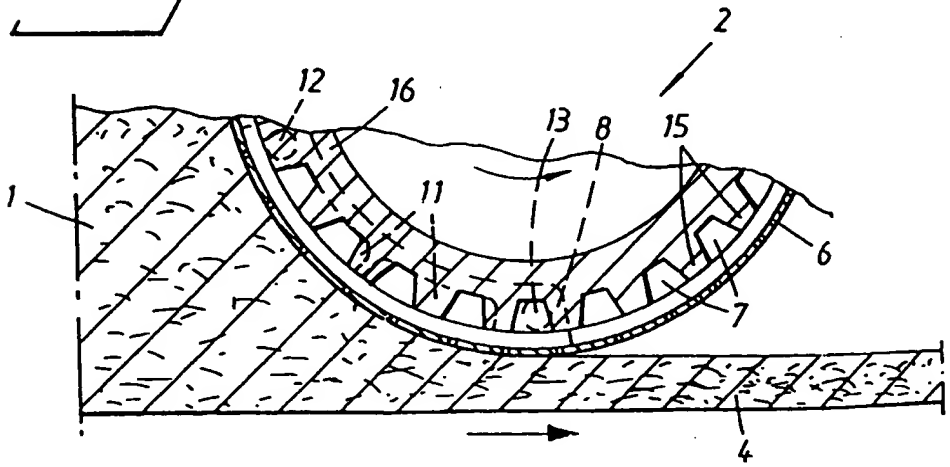


Fig. 4



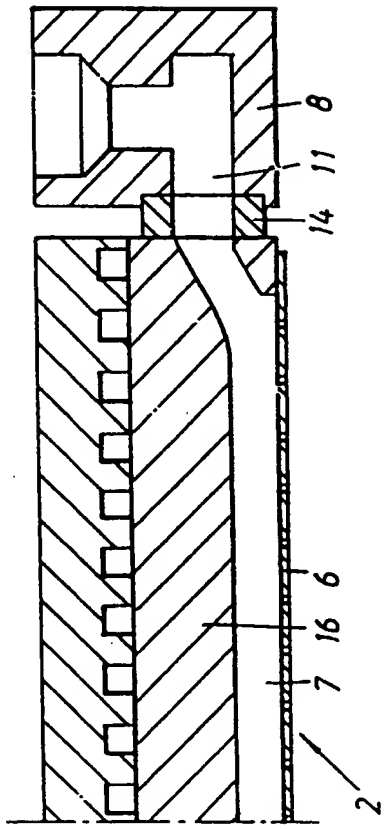


Fig. 5

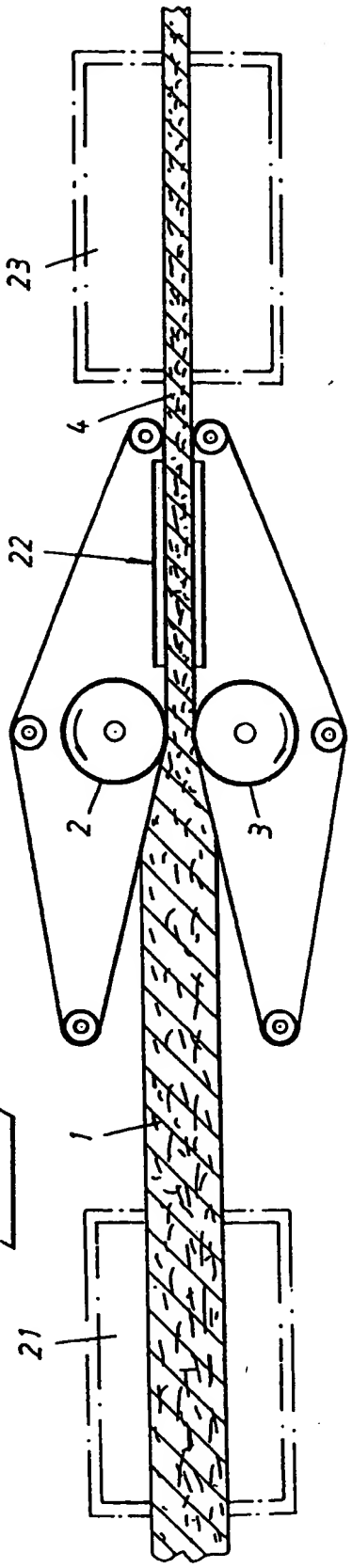


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 96/00974

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B27N 3/18
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B27N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DIALOG: ALLSCIENCE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	WO 9531318 A1 (SUNDS DEFIBRATOR INDUSTRIES AB), 23 November 1995 (23.11.95)	1

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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WO-A1- 9531318	23/11/95	AU-A- 2540995	05/12/95
		SE-C- 502810	22/01/96
		SE-A- 9401648	14/11/95